CLAIMS

What is claimed is:

1. A method for fabricating a field emitter tip, said method comprising:

positioning a group III-nitride semiconductor over a substrate;

patterning said group III-nitride semiconductor using a photoresist masked array; and

shaping said group III-nitride semiconductor into said field emitter tip using an inductively coupled plasma dry etching process.

2. The method of claim 1, wherein said inductively coupled plasma dry etching process selectively creates an anisotropic deep etch in said group III-nitride semiconductor.

3. The method of claim 1, wherein said inductively coupled plasma dry etching process creates an isotropic etch in said group III-nitride semiconductor creating generally pointed ends on said group III-nitride semiconductor.

4. The method of claim 1, wherein said inductively coupled plasma dry etching process creates an anisotropic deep etch in said group III-nitride semiconductor followed by an isotropic etch in said group III-nitride semiconductor creating generally pointed

ends on said group III-nitride semiconductor.

5. The method of claim 1, wherein said group III-nitride semiconductor comprises any of gallium nitride, aluminum nitride, aluminum gallium nitride, aluminum indium nitride, aluminum indium gallium nitride, gallium indium nitride, boron nitride, diamond, and other wide bandgap semiconductors.

6. The method of claim 1, wherein said inductively coupled plasma dry etching process comprises a four-step etch process.

7. The method of claim 1, wherein said photoresist masked array is approximately 1.7 microns in thickness.

8. The method of claim 1, wherein said tip has a radius of curvature of less than 100 nanometers.

9. The method of claim 1, wherein said inductively coupled plasma dry etching process is performed using gases comprising HBr, SF_6, Cl_2, and BCl_3.

10. A method of making a field emitter tip for use in a vacuum microelectronic device, said method comprising:

arranging a stacked structure comprising an underlying substrate layer adjacent to

a group-III nitride layer;

masking a photoresist layer adjacent said group-III nitride layer;

creating a generally circular array pattern in said photoresist layer and said group-III nitride layer; and

forming said group-III nitride layer into generally pointed shapes using an inductively coupled plasma dry etching process.

11. The method of claim 10, wherein said inductively coupled plasma dry etching process selectively creates an anisotropic deep etch in said group-III nitride layer.

12. The method of claim10, wherein said inductively coupled plasma dry etching process creates an isotropic etch in said group-III nitride layer.

13. The method of claim 10, wherein said inductively coupled plasma dry etching process creates an anisotropic deep etch in said group III-nitride layer followed by an isotropic etch in said group III-nitride layer creating generally pointed shapes on said group III-nitride layer.

14. The method of claim 10, wherein said group-III nitride layer comprises any of gallium nitride, aluminum nitride, aluminum gallium nitride, aluminum indium nitride, aluminum indium gallium nitride, gallium indium nitride, boron nitride, diamond, and other wide bandgap semiconductors.

15. The method of claim 10, wherein said photoresist layer is approximately 1.7 microns in thickness.

16. The method of claim 10, wherein said generally pointed shapes each have a radius of curvature of less than 100 nanometers.

17. The method of claim 10, wherein said inductively coupled plasma dry etching process is performed using gases comprising HBr, SF_6, Cl_2, and BCl_3.

18. The method of claim 10, wherein said group-III nitride layer comprises a material having a negative electron affinity.

19. A method of producing a field emission device, said method comprising:

laying a group III-nitride semiconductor layer over a substrate layer;

placing a mask over said group III-nitride semiconductor layer;

patterning a generally circular grid in said mask and said group III-nitride semiconductor layer; and

forming said group III-nitride semiconductor layer into generally pointed tips using an inductively coupled plasma dry etching process,

wherein said group III-nitride semiconductor layer comprises a group III-nitride semiconductor material having a negative electron affinity.

20. The method of claim 19, wherein said inductively coupled plasma dry etching process selectively creates an anisotropic deep etch in said group III-nitride semiconductor layer.

21. The method of claim 19, wherein said inductively coupled plasma dry etching process creates an isotropic etch in said group III-nitride semiconductor layer.

22. The method of claim 19, wherein said inductively coupled plasma dry etching process creates an anisotropic deep etch in said group III-nitride semiconductor layer followed by an isotropic etch in said group III-nitride semiconductor layer creating generally pointed tips on said group III-nitride semiconductor layer.

23. The method of claim 19, wherein said photoresist layer is approximately 1.7 microns in thickness.

24. The method of claim 19, wherein said tips have a radius of curvature of less than 100 nanometers.

25. The method of claim 19, wherein said mask comprises any of a photoresist mask, a nickel mask, and a chrome mask.

26. The method of claim 19, wherein said inductively coupled plasma dry etching process is performed using gases comprising HBr, SF_6, Cl_2, and BCl_3.